

**ABBREVIATED WORK PLAN – MAY 2018
VERTICAL PROFILE BORING (VPB177) / RECOVERY WELL (RW4) INSTALLATION FOR
RE108 HOT SPOT
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT (NWIRP), BETHPAGE, NEW YORK**

This abbreviated work plan has been prepared by Resolution Consultants (Resolution) for the Mid-Atlantic Division of the Naval Facilities Engineering Command (NAVFAC) pursuant to Contract Task Order (CTO) WE80, issued under Comprehensive Long-term Environmental Action Navy (CLEAN) contract number N62470-11-D-8013. This investigation is being conducted to better define the local aquifer hydrogeology and to support the remedial design for the RE108 hot spot treatment system of the Naval Weapons Industrial Reserve Plant (NWIRP) Bethpage, Long Island, New York (Figure 1).

Scope and Objectives

The objective of the field investigation is to further characterize the local aquifer and develop hydrogeological parameters needed to design a recovery well(s). The recovery well(s) is intended to hydraulically capture the RE108 hot spot groundwater contamination that is currently flowing and anticipated to flow through this area (Figure 2). Regional groundwater flow is south-southeast, but is locally affected by the operation of recharge basins and public water supply wells (Resolution Consultants, 2012). During the drilling of the recovery well, the lithology will be logged to assess the future locations and construction of the RE108 hot spot recovery well(s).

This investigation will consist of the following tasks:

- Drilling, logging, and sampling of one 8- to 10-inch vertical profile boring (VPB) to a depth of approximately 700 feet (ft) below ground surface (bgs). During installation of the VPB, groundwater samples will be collected using a Hydropunch™ and submitted to a laboratory for analysis of volatile organic compounds (VOCs) using EPA Method 8260C. In addition, a continuous lithologic log will be constructed based on drill cuttings, and split spoon samples will be periodically collected through the planned recovery well screen interval of 555 to 655 ft bgs. Upon completion of the boring, it will be geophysically logged for natural gamma and single point resistivity.
- Installation of one 12-inch recovery well near the VPB bore hole to a depth of approximately 655 ft bgs. The permanent recovery well will be surveyed and groundwater grab sample will be collected for VOC analysis using EPA Method 8260C.
- Installation of an underground vault 6 ft wide by 7 ft deep by 8 ft long in size.

Boring Location

The work will be conducted at one site, designated as VPB177, located 1.9 miles south of the NWIRP Bethpage and Northrop Grumman Corporation (NG) parcels. The worksite will be situated in the grass strip south of 282 Hicksville Road adjacent to a fenced lot. The boring location is not fenced and has open access from Hicksville Road in Bethpage, NY (Figure 1). Figure 2 provides the regional location of the proposed VPB and recovery well, and the location of the area of study. The drilling location is shown aerially in Figure 3.

Site History

NWIRP Bethpage is located in east-central Nassau County, Long Island, New York, approximately 30 miles east of New York City (Figure 1). NWIRP Bethpage is in the Hamlet of Bethpage, Town of Oyster Bay, New York. Since its inception in 1941, the plant's primary mission was research prototyping, testing, design engineering, fabrication, and primary assembly of military aircraft. The facilities at NWIRP included four plants used for assembly and prototype testing, a group of quality control laboratories, two warehouse complexes (north and south), a salvage storage area, water recharge basins, the Industrial Wastewater Treatment Plant, and several smaller support buildings.

The Navy's property originally totaled 109.5 acres and was formerly a Government-Owned Contractor-Operated (GOCO) facility that was operated by NG until September 1998. Prior to 2002, the NWIRP property was bordered on the north, west, and south by current or former NG facilities, and on the east by a residential neighborhood. By March 2008, approximately 100 acres of NWIRP property were transferred to Nassau County in three separate actions. The remaining 9 acres and access easements were retained by the Navy to continue remedial efforts at Installation Restoration (IR) Site 1 – Former Drum Marshalling Area and Site 4 – Former Underground Storage Tanks (Area of Concern [AOC] 22). A parcel of land connecting the two sites was also retained. Currently, the 9-acre parcel of NWIRP is bordered on the east by the residential neighborhood and on the north, south, and west by Nassau County property. Access to the NWIRP is from South Oyster Bay Road.

The hot spot area was confirmed in 2011 by the presence of trichloroethene (TCE) in groundwater at concentrations greater than 1,000 parts per billion (ppb) in the Bethpage Water District Plant 6 wells. During the course of further investigation led by Resolution, VPB142 and associated wells RE108D1 and RE108D2 were installed in October 2013. The subsequent consecutive quarterly groundwater sampling results established the boundaries of the present RE108 hot spot location. The hot spot plume is approximately 4,500 ft long by 1,990 ft wide as shown in Figure 2, and 500 to 800 feet deep.

Field Investigation Task Plan

Details of the field investigation are provided below. Performance of the field investigation will follow the Navy's *Uniform Federal Policy Sampling and Analysis Plan (UFP SAP) Addendum – VPB and Recovery Well Installation and Sampling* (Resolution Consultants, 2016).

Vertical Profile Boring and Recovery Well

The VPB will be installed to a depth of 700 ft below ground surface (bgs), and the recovery well will be drilled in the near vicinity to a depth of approximately 655 ft bgs. To prevent sloughing of the upper borehole, an auger rig will be used to over-drill the borehole to 11 inches in diameter and install a temporary, steel surface casing. The VPB will be advanced using mud rotary drilling techniques and the borehole will be 8 to 10 inches in diameter. Drilling mud will consist of potable water and polymer-free sodium bentonite or equivalent. Drilling mud will be contained and re-circulated in a baffled, high-capacity mud pan.

The well borehole will be constructed using reverse circulation drilling technique with the casings installed plumb and true to line. The anticipated finished depth of the well will be approximately 655 ft bgs. A well construction diagram is presented in Attachment A.

Soil Sampling during VPB and Recovery Well Installation

Samples of the VPB drill cuttings will be logged by the geologist to construct a descriptive lithologic log of the entire bore hole.

Up to 12 split spoon samples will be collected from ground surface to a depth of 700 ft. Samples will be collected when a change in geology is observed in the field. Samples will be logged by the field geologist and screened for VOCs utilizing a photoionization detector (PID). These samples will be used to confirm the eventual gamma logging of the boring. Up to two soil samples for total organic carbon (TOC) analysis will be collected.

During the advancement of the recovery well, split spoon samples will be collected at 20 ft intervals in the planned screen interval and submitted for grain size by Resolution. For the purpose of this scope, a maximum screen length of 100 ft (555 to 655 ft bgs) is assumed. An additional five (5) split spoons may be collected for purposes of logging.

Groundwater Sampling during VPB Installation

VPB groundwater samples will be collected every 50 ft for the first 200 ft of borehole depth. After the first 200 ft, groundwater samples will be collected every 20 ft until the boring terminates (see

Table 1). Groundwater samples will be collected via Hydropunch™ which will be advanced ahead of the drill bit (and drilling mud) with a drive pipe. At the target depth, the drive pipe will be pulled up 1 to 2 feet to expose the screen and the water sample will be collected for VOC analysis using EPA Method 8260C (see Table 2). During the collection of groundwater samples, field parameters will be measured by Resolution (pH temperature, specific conductivity, oxidation reduction potential, dissolved oxygen, depth to water flow rate and turbidity) as the water sample volume permits.

Geophysical Logging

Borehole geophysical logging will be conducted in the VPB following advancement to total depth. Once the drilling tools are removed from the borehole, a geophysical probe will be run down the borehole and back up. The VPB will be logged for natural gamma and single-point resistivity and the log traces will be inspected in the field for completeness prior to demobilization.

Air Monitoring

Resolution will perform air monitoring for site-related contaminants during the VPB/ recovery well drilling and well completion, and will direct personnel as to the minimum level of PPE to be worn. One air sample per VPB will be collected to document ambient levels of VOCs in the work area air during installation of the VPB boring. A community air monitoring plan (CAMP) will also be followed during installation of the VPB and recovery well; details of the CAMP are provided in the *Health and Safety Plan – Site 1 OU-2 Off Site TCE Groundwater Plume Investigation* (Resolution Consultants, 2012) which follows procedures outlined by the New York State Department of Environmental Conservation (NYSDEC) DER-10.

At a minimum, personnel will work in modified Level D protection. Upgrading to Level C is not anticipated, but is specified in the *Health and Safety Plan* as a contingency for some portions of the work specified herein.

Recovery Well Installation

The recovery well (RW4) will be installed using the reverse circulation drilling technique. The 12-inch well is anticipated to be used as part of the final groundwater extraction system. The well will be installed in an 18-inch diameter borehole and consist of 12 inch schedule 40 black steel casing, 100 ft (screen length assumed) of 12 inch ID Hi-Flow 304 stainless steel well screen, filter pack, sand and bentonite seals, and grout. The well will be finished in an underground vault that is 6 ft wide by 7 ft deep by 8 ft long in size.

For the purpose of this scope, a maximum screen length of 100 ft is assumed. Threaded bottom caps will be fitted to the bottom of the well. Well centralizers will be installed at an interval of approximately 40 to 50 ft. A permanent 20-inch steel surface casing (60 ft in depth) set in concrete will be used to support the upper borehole walls. The well will include a submersible or turbine pump with a pumping capacity of 400 to 700 gallons per minute (gpm). The details of well construction are provided in Attachment A.

The anticipated finished depth of the well will be approximately 655 feet (See Table 3 for details). If, in the opinion of the Resolution's geologist, the well may be out of plumb or alignment, it shall be tested at the drilling subcontractor's expense in accordance with Appendix D of the American Water Works Association ANSI/AWWA A100-15.

- For the purposes of this work plan, the filter pack is anticipated to consist of #1 quartz sand installed using a tremie pipe. The well gravel pack will be placed a minimum of 25 feet above top of screen.
- A fine sand layer (finer than gravel pack) will be placed in the annulus on top of the gravel pack in the same manner as the gravel pack, approximately 15 feet thick above the top of the gravel pack.
- A 4- to 8-foot thick bentonite seal will be installed above the fine sand layer. The annulus above the bentonite seal will be grouted with Volclay© (or similar) high-solids bentonite slurry. Both the bentonite seal and bentonite slurry will be installed using a tremie pipe. The well will be completed at the surface with a locking curb box, set in an underground vault 6 ft wide by 7 ft deep by 8 ft long in size (vault construction is described below). A layer of fine sand will be installed above the grout slurry and inside the curb box to allow for drainage of water from the curb box. The top of well riser will be set approximately 6 inches below grade. A lockable gripper cap will be installed on the well riser top.

Recovery Well Development

Following installation, RW4 will be developed to evacuate drilling mud, silts and other fine-grained sediments which may have accumulated within the well during its installation. Well development will not commence until at least 24 hours after well installation. Due to the depth of the well, it is anticipated that the well will be developed using air lift methods and over pumping using a submersible pump. The drilling subcontractor will provide the pump needed to develop the well.

Development will continue until turbidity has stabilized (less than 50 nephelometric turbidity units [NTU] if possible). Special care will be taken to develop the well properly in order to ensure adequate hydraulic connection between RW4 and the aquifer. An alternate and equally effective method or variation may be used to develop the well if required, but must be approved by Resolution prior to implementation.

The recovery well will be developed at a rate similar to the pumping rate. The specific capacity of the well (discharge rate/feet of drawdown) will be measured manually; drawdown during development and static following equilibration after development. Water from the development activities (anticipated to be one pre- and one post-development) will be sampled by Resolution and discharged directly to conveyance piping to the GM-38 treatment system. The aqueous grab sample will be analyzed by a New York State and Navy-approved laboratory for the Target Compound List (TCL) using Environmental Protection Agency (EPA) Methods as per the following:

<u>Analytes</u>	<u>EPA Method of Testing</u>
Volatile Organic Compounds (VOCs)	8260C
Semi Volatile Organic Compounds (SVOCs)	8270D
Total Suspended Solids (TSS)	2540D
pH	4500_H+B
Biological Oxygen Demand (BOD)	5210B
Total Dissolved Solids (TDS)	2540C
Total Kjeldahl Nitrogen (TKN)	351.2
Ammonia	350.1
1,4 Dioxane	8270D SIM
Total Metals/Dissolved Metals	6020A/7470A

Installation of the Vault

Following the installation of RW4, an underground vault will be installed housing the well. The vault will be 6 ft wide by 7 ft deep by 8 ft long, precast with loose bottom and loose H20 rated top including one (1) 24 inch manhole over well and one (1) 24 inch manhole with ladder and wall sleeves for the 6 inch main and future electric conduit.

The vault will be installed with a 6 inch flanged gate valve, 6 inch flanged check valve and 6 inch flanged flow meter with totalizer in gallons including supports and thrust rodding. Fittings will be installed in line with wall sleeve to allow for connection from outside main.

Investigation Derived Waste

Investigation derived waste (IDW) accumulated during drilling activities will be collected, containerized, and disposed of off-site. Soil and mud will be transferred to either roll offs for solid waste or to a frac tank for liquids. Development and purge water will be sampled by Resolution and discharged directly to conveyance piping to the GM-38 treatment system. Liquid muds will be transferred to frac tanks located at the staging area.

Decontamination

The decontamination pad at NWIRP Bethpage will be used for the collection of all decontamination-generated fluids. All decontamination fluids will be collected and staged for characterization and subsequent disposal. All decontamination activities will be consistent with the *UFP SAP Addendum – VPB and Monitoring Well Installation and Sampling* (Resolution Consultants, November 2013).

Surveying

The location of the VPB and newly installed well will be surveyed by a New York State licensed surveyor. All surveying activities will be consistent with the *UFP SAP Addendum – VPB and Monitoring Well Installation and Sampling* (Resolution Consultants, November 2013).

Utility Clearance

Prior to the initiation of intrusive fieldwork, the drilling subcontractor will contact Dig Safely New York to arrange for the location and marking of all underground utilities in the vicinity of the proposed soil boring and recovery well locations, as required by the New York Code of Rules and Regulations (NYCRR) Part 753. The drilling subcontractor will make the one call ticket available for review. In addition to the one call ticket, Resolution will contract a private utility company to confirm utility locations.

In general, prior to advancing the soil boring or well using a drill rig, each boring location will be hand excavated to a minimum depth of 5 ft bgs with the diameter being greater than the augers to be employed. Excavations will be performed to locate any utilities that may have been marked incorrectly, are privately owned, have been abandoned, were not known to exist, or were not detectable by surface investigation methods. Hand-clearing will be performed by the drilling subcontractor utilizing decontaminated hand augers, shovels, posthole diggers, or other non-mechanical means.

Data Validation

After receipt of analytical laboratory results, Resolution Consultants will verify data completeness as specified on Worksheet #34 of the *UFP SAP Addendum – VPB and Recovery Well Installation and Sampling* (Resolution, November 2013). To ensure that the analytical results meet the project quality objectives, the laboratory data will undergo verification and validation as cited in Worksheets #34 through #36 and described below. The data usability assessment process is described in Worksheet #37.

All data (100%) will undergo verification and U.S. EPA Stage 2B electronic and manual validation. Prior to data validation, electronic laboratory data will be verified for accuracy against the hardcopy laboratory report and the electronic quality assurance project plan (eQAPP) will be established using the project-specific criteria defined in Worksheets #12, #19, #24, and #28 of the UFP SAP. The laboratory will be requested to resubmit electronic data found to be inaccurate.

During the data validation process, the Resolution Consultants Data Validation Assistant (DVA) tool will be used to review method accuracy and precision data from field and laboratory QC samples contained in the laboratory electronic data deliverable and to qualify that data according to the project-specific eQAPP. The DVA tool uses EarthSoft's Environmental Quality Information System relational database to assemble a series of Excel worksheets into a DVA workbook for the validator that provide:

- Data validation QC elements that need review, compared to control limits stored in the project-specific eQAPP.
- Associated sample results for duplicated samples and blanks.
- A place to make the necessary qualifications and result updates directly into an electronic format documentation of qualifications using coded reasons.
- A list of all samples affected by the qualification.

The analytical data report will be manually reviewed for data not provided in the electronic data files (e.g., sample handling, tuning, and calibration). VOCs, SVOCs, 1,4-Dioxane (via Selective Ion Monitoring [SIM]), total and dissolved metals, TDS, TSS, ammonia, nitrogen, and BOD will be assessed against the criteria presented in the UFP SAP, Department of Defense (DoD) *General Data Validation Guidelines* (DoD, 2018), and Modules, *National Functional Guidelines for Organic Superfund Methods Data Review* (United States Environmental Protection Agency [U.S. EPA] 2017a), *National Functional Guidelines for Inorganic Superfund Methods Data Review* (U.S. EPA 2017b), and the Department of Defense Quality Systems Manual Version 4.2 (DOD, 2010). The results of these findings will be added to the Excel DVA workbook. The DVA workbook is used to

update the project database with the validator's changes, eliminating the manual data entry process and allowing for 100% of data to be reviewed prior to uploading to the project database. The results of the data validation will be documented in reports which will detail any issues impacting the data quality along with qualifications affecting data bias and usability.

Reporting and Schedule

Form 1 results from the analytical lab will be provided to the Navy and regulators as soon as the data are available. Subsequent summary reports including VPB and recovery well installation details, and sampling results will be developed to provide documentation of this investigation. Documentation required to support this project will consist of the following items:

- Scanned copies of the field book during VPB and recovery well installation. This may be presented as a separate deliverable.
- Updated cross sections based on the boring log
- Field copies of the boring log for each boring
- Paired graphic of VPB VOC concentration in groundwater with gamma log
- Groundwater, soil, and air sample log sheets
- Well completion form
- Well development record
- Map identifying newly installed recovery well.

The project schedule is presented as Table 4.

References

Department of Defense, 2010. *Quality Systems Manual Version 4.2*. October 2010.

Department of Defense, 2018. *General Data Validation Guidelines*.

Resolution Consultants, 2012. *Health and Safety Plan – Site 1 OU-2 Off Site TCE Groundwater Plume Investigation Naval Weapons Industrial Reserve Plan (NWIRP) Bethpage NY*. May 2012.

Resolution Consultants, 2013. *Uniform Federal Policy Sampling and Analysis Plan (UFP SAP) Addendum – VPB and Monitoring Well Installation and Sampling. Naval Weapons Industrial Reserve Plan (NWIRP) Bethpage NY*. November 2013.

Resolution Consultants, 2014. *Uniform Federal Policy Sampling and Analysis Plan (UFP SAP) Addendum – Inclusion of Additional Target Analytes for Volatile Organic Analyses. Naval Weapons Industrial Reserve Plan (NWIRP) Bethpage NY.* August 2014.

New York State Department of Environmental Conservation, 2010. *DER-10 / Technical Guidance for Site Investigation and Remediation.* May 3, 2010.

United States Environmental Protection Agency 2017a. *National Functional Guidelines for Organic Superfund Methods Data Review.*

United States Environmental Protection Agency 2017b. *National Functional Guidelines for Inorganic Superfund Methods Data Review.*

Tables

Table 1
Vertical Profile Boring and Recovery Well Groundwater Sampling Program
Page 1 of 1

Boring Number	Drilling Method	Total Depth (feet) ⁽¹⁾	Depth (feet)	Split Spoon Sampling	Groundwater Sampling	Gamma Log	Air Sample ⁽²⁾
VPB177	MR	~700	50 to 200	0	50, 100, 150, and 200 feet (4 samples)	Yes	Yes
			200 to 700	Up to 5	20-foot intervals (25 samples)		
RW4	RC	~655	655	Up to 5	1	No	No

1. Total depth will be approximately 7 feet below ground surface.

2. Work area summa canister (6 to 8 hours).

VPB: Vertical Profile Boring

MR: Mud Rotary

RC: Reverse Circulation

Table 2
Vertical Profile Boring and Recovery Well Analytical Summary
Page 1 of 1

Location	Sample ID	Matrix	Number of Samples		
			VOCs – Quick Turn ⁽¹⁾	Grain size ⁽²⁾	VOCs – TO 15 ⁽³⁾
VPB177	VPB177-Soil- MMDDYY XX-XX	Soil	--	~ 5	--
	VPB177-GW- MMDDYY XX-XX	Groundwater	~30-	--	--
	VPB177-AIR- MMDDYY	Air	--	--	1 per VPB
RW4	RW4-Soil- MMDDYY XX-XX	Soil	5	~ 5	--
	RW4-GW- MMDDYY XX-XX	Groundwater	1	--	--

Notes:

1. 24-hour results from local laboratory via method SW846 8260C or equivalent method.
2. 21-day results from Navy-approved laboratory via ASTM422.
3. 21-day results from Navy-approved laboratory via TO-15.

VOCs: Volatile organic compounds

MMDDYY: Sample date in month, day, and year. For example, June 1, 2018 would be 060118.

XX-XX: Bottom of sample interval, in feet. For example, a groundwater sample collected in VPB177 at 100 to 102 feet below ground surface on June 1, 2018 would be VPB177-GW-060118(100-102).

Table 3
Proposed Recovery Well Installation Summary
Page 1 of 1

Location	VPB	Screened Interval Feet	Total Depth Feet	Height of Filter Pack Sand Feet	Height of Fine Sand Feet
RW4	VPB177	100	655*	25 feet above screened interval	15 feet above sand

Note:

* – Estimated; final depth to be determined.

Table 4
Project Schedule
Page 1 of 1

Task Name	Duration	Start	Finish
Overall Project Schedule – April 2, 2018	316 days	Mon 4/2/18	Mon 6/17/19
Work Plan	95 days	Mon 4/2/18	Fri 10/12/18
Draft Work Plan to Navy	20 days	Tue 4/3/18	Mon 4/30/18
Navy Comments	30 days	Tue 5/1/18	Mon 6/11/18
Final Work Plan	24 days	Tue 6/12/18	Fri 7/13/18
NYSDEC Approval	20 days	Mon 7/16/18	Fri 8/10/18
NYSDEC Withdrawal Permit	45 days	Mon 8/13/18	Fri 10/12/18
Drilling	173 days	Thur 4/26/18	Mon 12/24/18
Development of SOWs	21 days	Thu 4/26/18	Thu 5/24/18
Evaluation and Award of SOWs	10 days	Mon 5/28/18	Fri 6/8/18
Mobilization/Fence Modification/GAC/Datalogger deployment	10 days	Mon 10/15/18	Fri 10/26/18
VPB Boring installation	20 days	Mon 10/29/18	Fri 11/23/18
Gamma and resistivity logging	1 day	Mon 11/26/18	Mon 11/26/18
Well installation	10 days	Tue 11/27/18	Mon 12/10/18
Well development	5 days	Tue 12/11/18	Mon 12/17/18
Demobilization	5 days	Tue 12/18/18	Mon 12/24/18
Data analysis and Reporting	127 days	Tue 12/24/18	Mon 6/17/19
Internal Draft report	45 days	Tue 12/25/18	Mon 2/25/19
Navy Review	30 days	Tue 2/26/19	Mon 4/8/19
Draft Report	20 days	Tue 4/9/19	Mon 5/6/19
Final report	30 days	Tue 5/7/19	Mon 6/17/19

Definitions:

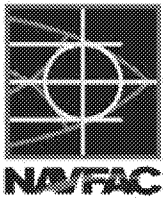
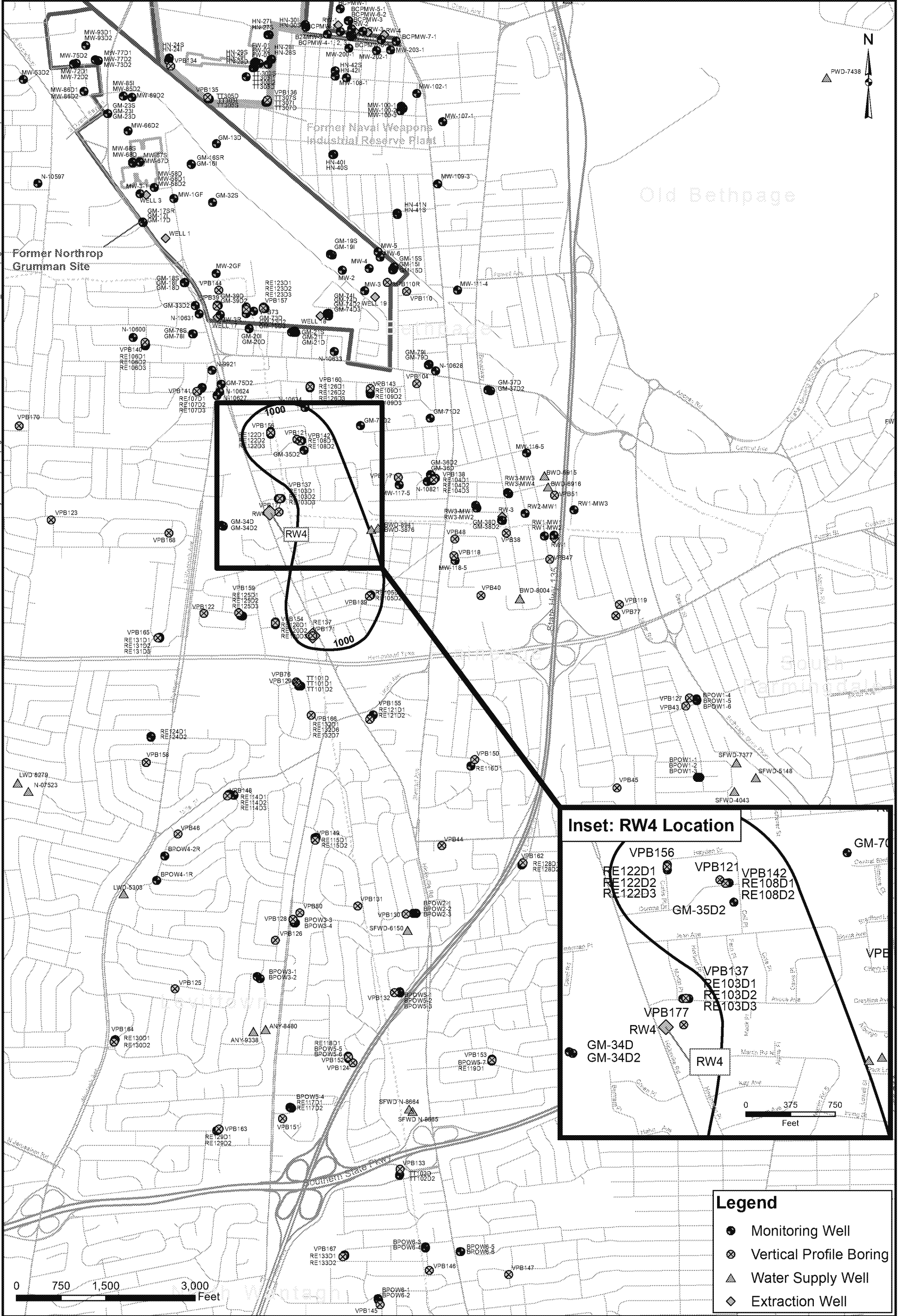
UFP SAP = Uniform Federal Policy Sampling and Analysis Plan

SOW = Scope of Work

NYSDEC = New York State Department of Environmental Conservation

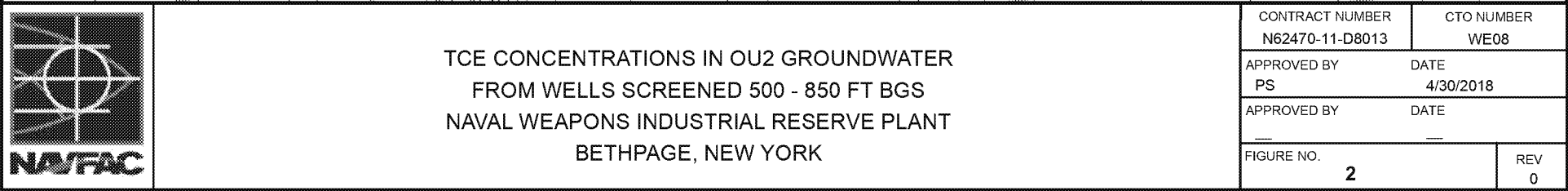
Figures

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RW4 LOCATION MAP
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

CONTRACT NUMBER N62470-11-D8013	CTO NUMBER WE15
APPROVED BY PS	DATE 5/18/2018
APPROVED BY	DATE
FIGURE NO. 1	REV 0



Attachments


Attachment A

Well Construction Detail



Client:		WELL ID:	
Project Number:			
Site Location:			Date Installed:
Well Location:			Inspector:
Method:		Contractor:	

MONITORING WELL CONSTRUCTION DETAIL

		Depth from G.S. (feet)	Elevation(feet)
	Top of Flush Mount Well Cap	0.0	
	Top of Riser Pipe	0.000	
	Riser Pipe:		
	Length	0.00	
	Inside Diameter (ID)	12-Inches	
	Type of Material	Stainless steel	
% Cement			
% Bentonite			
% Native			
	Top of Bentonite		
	Bentonite Seal Thickness		
	Top of Sand		
	Top of Screen		
	▼ Stabilized Water Level		0
	Screen:		
	Length		
	Inside Diameter (ID)		
	Type of Material		
	Bottom of Screen		
	Bottom of Borehole		
	Borehole Diameter:		
		Date	